SCIENCE.

FRIDAY, MARCH 25, 1887.

COMMENT AND CRITICISM.

PROF. ALFRED MARSHALL, the university successor of Fawcett, comes forward in the current number of the *Contemporary review* to propose remedies for fluctuations of general prices. His thesis is that the greater part of the fluctuations of general prices are not of such a nature as to be capable of being diminished, as some suppose, by the adoption of two metals instead of one as the basis of currency, but that the true and only effective remedy for them lies in divorcing the currency from the standard of value, and establishing some other and authoritative standard of purchasing power independent of the currency. This is a plan by no means new in the literature of economics, but Professor Marshall urges it with particular reference to present economic conditions. His first step is to prove the evils of a fluctuating standard of value, which is a tolerably easy task. The second step will meet with more opposition; namely, that the precious metals cannot afford a good standard of value. By an ingeniously constructed diagram, the writer illustrates the fact that prices show about as much variation when estimated in terms of the two metals, gold and silver, as they do when estimated in gold alone. From this he infers that the adoption of a bimetallic standard would, in the long-run, give us prices hardly more stable than they are now. In order to the establishment of a bimetallic standard, however, negotiations with other countries would have to be entered into. Before undertaking this, Professor Marshall asks that inquiry be made as to whether the standard of value ought not to be altogether independent of the currency.

"The industrial arts generally," says the writer, "have progressed by substituting several specialized instruments for one that used to be applied for many purposes. The chisel and the plane, the hammer and the saw, are all developments of the primeval tomahawk: they do their work well, because none of them is expected to cover a wide range of work. And so, if we have one thing as a medium of exchange, and another as a standard of value, each may be able to perform its share of the work thoroughly well, because it is specially fitted for it. The currency will retain a material form, so that it may 'run' from hand to hand as a medium of exchange; while the amount of the currency which is required to discharge a contract for deferred payment will be regulated neither by weight nor measure, but by an authoritative table of figures issued from time to time by a government." This supposititious government department, then, would extend to all commodities the action now taken by the English commissioners of tithes with regard to barley, wheat, and oats. It would ascertain from time to time the prices of all important commodities, and publish at intervals the amount of money required to give the same purchasing power as one pound had at the beginning of, say, 1887. This standard unit of purchasing power Professor Marshall would call the 'unit.' In effecting a loan, it could be made in currency or in units. If made in units, the lender would know that whatever change might take place in the value of money, whether it were an appreciation or depreciation, he would receive on the repayment of his loan an amount of money that would enable him to purchase just as much and as many commodities as the amount he had loaned. Under this plan Professor Marshall believes that the heavy risks caused by a general rise and fall in prices would be avoided, and each trade would be left to contend with its own peculiar dangers only. His standard, he admits, would not be free from all imperfections, nor always easy to obtain, but it would be as serviceable for its purpose as a yard-measure, and the same sort of an advance over the use of the value of gold, or even the mean between the values of gold and silver, as a standard, as is the substitution of the yard-stick for the length of the foot of one judge or for the mean between the lengths of the feet of two.

THE RESULTS OF THE STUDY of typhoid-fever in both this country and Europe during the past decade have been of great value to sanitarians and to the public. It would seem that the facts already discovered must indicate methods by which this disease, which is well-nigh universal,

may be controlled, and perhaps ultimately exterminated. There seems to be no doubt that the bacillus which was described by Eberth in 1880 is the germ of the disease. On this point Dr. Sternberg, in a paper read at the meeting of the Association of American physicians, says that pathologists are disposed to accept this bacillus as the veritable 'germ' of typhoid-fever, notwithstanding the fact that the final proof that such is the case is still wanting. This would consist in the production in man, or in one of the lower animals, of the specific morbid phenomena which characterize the disease in question, by the introduction of pure cultures of the bacillus into the body of a healthy individual. Evidently it is impracticable to make the test upon man, and thus far we have no satisfactory evidence that any one of the lower animals is subject to the disease as it manifests itself in man. Typhoid-fever discharges have been fed to swine, apes, dogs, cats, guinea-pigs, rabbits, white mice, calves, and fowls, without any positive results. The evidence upon the etiological relation which Eberth's bacillus bears to typhoid-fever is summed up as follows: No other organism has been found, after the most careful search, in the deeper portions of the intestinal glands involved in this disease, or in the internal organs. On the other hand, this bacillus has been demonstrated to be constantly present. The various facts observed in connection with this disease indicate that it is due to a micro-organism which is capable of multiplication external to the human body in a variety of organic media, at comparatively low temperatures, and that it is widely distributed. From the endemic prevalence of the disease over vast areas of the earth's surface, we may infer that it is induced by a hardy micro-organism which forms spores. Eberth's bacillus complies with all of these conditions. The paper of Dr. Sternberg is an admirable *résumé* of all that is best in modern experimentation and research in connection with this bacillus, and may be found in the Transactions of the association of American physicians.

AS SPRING APPROACHES, the interest in cholera begins to revive. It will be remembered that last year a cholera commission was despatched from England to Spain to study the epidemic in that country. The members of the commission were Drs. Ray, Graham Brown, and Sherrington, and represented the Royal society, the University of Cambridge, and the Association for the promotion of scientific research. In a preliminary report recently made by them, some of the results of their investigation are given. They failed to find Koch's bacillus in all the cases, and they do not look upon it as being the cause of the disease. They claim to have discovered a new fungus, which has been pronounced to belong to the Chytridiaceae. It consists of granular masses and a delicate mycelium. The commission evidently do not feel thoroughly convinced that they have discovered the veritable germ of cholera, as they recognize that further investigation is necessary before its etiological relation to cholera is firmly established. For our part, we prefer to accept the views of Koch, whose experience gives him opportunities for investigation possessed by few.

FOR SEVERAL YEARS PAST, a suspicion has been current among students of glaciology in this country that the European studies of the drift were not advanced quite as far as similar studies with us. It is not only that our terminal moraines have been traced and mapped with unexpected detail, but they have given great additions to the evidence for land ice as against floating ice action, and they have vastly increased our knowledge of the style of motion characteristic of a continental ice-sheet. Similar revelations have heen expected concerning the extinct ice-fields of Europe, as soon as their marginal deposits should receive proper correlation, and the expectation seems well justified by the work of Mr. Carvill Lewis of Philadelphia, who during a two-years' trip abroad has attempted the investigation of the English and Irish drift-margins after what may be called the American method His studies were presented at last summer's meeting of the British association, and are now published in the *American naturalist* and in the *American journal of science.* They give account of curvature and irregularity in the drift-front, of interlobate moraines with kettle-hole topography, like the classic example is Wisconsin, — for in this matter we have our classics at home, — and of the critical differences between the working of floating bergs and creeping sheets. This must excite interested comment from those who have not yet made such interpretation of glacial deposits, and awaken agreeable anticipation of the greater discoveries yet to be made on continental Europe.

Another interesting effect of American geological work in Europe appears in a small way in

the annual of the French Alpine club for 1884. Mr. de Margerie, whose studies of our recent geological literature have done much to make it known in France, a few years ago prepared reviews of Captain Dutton's monograph of the Colorado Cañon, and published them in the bulletin of the French geological society as well as in the annual of the Alpine club, inciting thereby the preparation of an admirable view of a great 'cirque' in the Pyrenees by Mr. Schrader, a fellow club-member. "Shall it be," says Schrader, "that the cañon of the Colorado, so far away, becomes better known in France than the Cotuatero, on the very frontier of the country?" Doubtless the dimensions of the American plateau and cañon are greater than those of the massive Cotuatero and cirque in the Pyrenees, but the latter have the advantage in rising from a forest-clad base to a snow-crowned summit. The colored plate illustrating the Cotuatero is a thoroughly artistic and appreciative work, and it is grateful to find that the illustrations in our survey reports have been instrumental in securing its publication, and in bringing it before an interested circle of the French public.

These European Alpine clubs are producing a valuable literature of their own. They have, to be sure, the advantage of high snow-mountains that tempt travel and climbing; their membership is large, with many sectional meetings and excursions; and their treasuries are correspondingly well supplied, enabling them to publish selected material in well-illustrated annual volumes. The English Alpine club is more conservative than most of the others in these respects, as its matter is largely composed of narratives such as its adventurous members can well contribute, not only from the Alps, but from the Caucasus, the Himalaya, New Zealand, and the Andes, where they now seek new fields, taking trained Swiss guides with them. The Swiss club holds closely to its own country, but gives a good share of attention to scientific matters in its line, as well as to narratives and descriptions. Forel reports, for example, on the oscillations of glaciers; and our summer travellers will be glad to see from his diagram that the recession of the ice, that lately threatened seriously to diminish one of the main attractions of the Alps, reached its maximum about 1876, and is now followed by a well-marked advance. Long panoramic views from mountain-summits make a characteristic feature of these volumes, an annual bibliography of Alpine literature adds much to their value, and an index lately prepared for the first twenty volumes greatly increases their utility. The first volume is unfortunately extremely rare, as is the case in several other clubs; and a republication of the early numbers, such as has been lately done by our active Appalachian mountain club, would give general satisfaction.

The German-Austrian club is a union of two originally independent societies, and has a very large membership. Under its auspices an excellent 'Guide to scientific observation on Alpine journeys' was published a few years ago, and is by far the best book of its kind. The annual of the French club is naturally more vivacious than any of these others. Its articles are attractively written, and many of the woodcuts are extremely good. Scientific papers have a good showing, though lacking the systematic sequence of those in the Swiss 'Jahrbuch.' Some of the narratives have so little to do with Alpine matters that the annual might almost be called a geographic journal. Deep-sea exploration is introduced under the title of 'Les montagnes de le mer,' and Janssen describes his astronomical voyage in the Pacific to the Caroline Islands, any thing but a mountainous isle, for the solar eclipse of 1883. But to make up for this, one member climbs and photographs Popocatapetl, and another visits the volcanoes of Java, bringing home a well-illustrated account of his travels. The Alps naturally have most attention, but the Pyrenees come in for a good share, and much information of this comparatively little-known range is to be found in these attractive volumes. It is indeed regrettable that our White Mountains have not the few thousand additional feet of elevation that would cover their summits with snow and fill their valleys with glaciers, to the admiration of all.

A RECENT BULLETIN of the U. S. fish commission states that the total distribution of shad fry for the season of 1886 amounted to 90,000,000. As the entire number of shad taken for the market is less than 6,000,000, it will be seen, that, for every shad taken from the waters this season, there have been artificially hatched and returned to the waters fifteen young shad. Assuming that the entire cost of production and distribution has been $20,000, the young fish have been produced and distributed over the entire United States at a

rate of about $215 a million, or about 46 fry for one cent. Another interesting fact to note is, that, for the entire time up to and including 1882, there were produced 200,000,000 young shad; while, for 1883 alone, the total was over 90,000,000. This indicates that we are certainly approaching a position where the work may be regarded as profitable from a commercial stand-point.

THE COAST TRIBES OF BRITISH COLUMBIA.

Dr. Franz Boas, who visited the tribes of British Columbia in the fall of 1886, gives the following preliminary report (with map) on some results of his journey: —

Vancouver Island and the mainland opposite are inhabited by numerous tribes, which belong to three linguistic stocks, — the West Vancouver tribes, of the outside coast of Vancouver Island; the Selish tribes, which occupy the south-east part of the island as far as the narrows separating it from the mainland, and inhabit the banks of the lower part of Fraser River and the neighboring fiords; and the Kwakiutl tribes, which occupy the northern part of the island, and the mainland as far north as Gardner Channel. The latter tribes surround the territory of the Bilhula of Bentinck Arm and Dean Inlet, a tribe belonging to the Selish stock. Farther north we find the Tsimpshian and Tlingit on the mainland, and the Haida on Queen Charlotte Islands.

The Selish language is divided into a great number of dialects, differing widely from one another. Under the name 'Coast Selish' we include the dialects of Puget Sound and of the Gulf of Georgia, as those dialects are more closely connected with one another than with the Selish dialects of the interior.

Through the descriptions of Swan, Sproat, Krause, and others, the mode of life of these tribes is tolerably well known. Their large wooden houses, their canoes, their fishing-gear and hunting-methods, have been frequently described; but their traditions, religious ideas, and social organization are not known equally well. According to all observers, the principal figure in the mythology of the Tlingit is the raven Yetl, who created the sun, moon, and stars, who gave man the fresh water and the fish, and whose exploits are said to be so numerous that a lifetime is not sufficient to relate them all. Dawson found the same traditions among the Haida; and, according to the Rev. Mr. Duncan, the Tsimpshian tell the same stories of Tghemshen, the man who was able to transform himself into a raven. It is a characteristic feature of the 'raven' legend that the bird did not create all things for the benefit of mankind, but in order to revenge himself. While studying the tribes of Vancouver Island, numerous traces of this legend were found, though only very fragmentary and disconnected. Among these people the raven is not considered the creator of the sun, the water, the trees, etc.; but his adventures, which generally refer to his voracious appetite, and his cheating people and animals in order to satisfy it, are frequently related by the natives.

The most important legends of the Kwakiutl are those referring to Kanikilak. They believe in a supreme being living in heaven, whom they call Kantsoump ('our father,' or, in some instances, 'our elder brother'). He sent down to the earth his two sons Kanikilak and Nomokois, who were born there again of a woman, the wife of the woodpecker. Their mother's blanket contained the salmon, which they liberated by dipping the corner of the blanket into the water. Then Kanikilak travelled over all the world, becoming the friend of all the mighty chiefs whom he met on his way, and transforming all the malignant men into animals. The name, in the Kwakiutl language, of those ancient beings who were neither men nor animals, is Nughnemis. We find the same or a similar tradition belonging to all the tribes from Puget Sound to the district of the Tsimpshian. Among the Selish tribes the name of the son of God is Häls; among those of the west coast the name is Alis. The northern tribes — the Tsimpshian, Haida, and Tlingit — tell of those human-like beings which were transformed into animals during a great flood.

The supreme being spoken of above seems to have originally been the sun, though the identity of both does not appear very distinctly in the traditions of the natives. However, their ancient identity may have been lost in course of time, as among all the tribes legends of different origins are evidently intermixed. In the same way as the raven story has spread south, losing on the way its important place in the mythology of the tribes, the Kanikilak story seems to have spread north; and the traditions, in their present state, seem to consist of elements of at least two different origins. The Skoamish call the sun 'the great wandering chief.' The Nanaimo (Snanaimugh), in speaking of the sun as the supreme being, call it Shimthayith. The Bilhula call their supreme being, besides Taata ('our father'), by the name Sngh, which is evidently connected with *sōngh* ('sun'). In the Kwakiutl legends the sun is the father of the mink, and this tradition is so closely connected with others relating to the

supreme being, that the identity of both becomes highly probable. The tribes of the southern part of Vancouver Island ascribe to the mink all the exploits that are told farther north as having been accomplished by the raven, and add a great number of others which belong to the mink alone. The Qomoks of the central part of Vancouver Island relate both traditions separately. Those of the raven refer to its voracious appetite, while those of the mink have a highly erotic character.

The Qomoks, Heiltsuk, and the Bilhula of Bentinck Arm are particularly interesting, as we may observe with them the transferrence of legends from one tribe to another. The Bilhula have a tradition of their own describing the origin of mountains, woods, and animals, which, though influenced by the legends of the Tlingit and Tsimpshian, has a peculiar character. They say that after the raven had created the sun, four men — Masmasalanigh, Yulatimot, Matlapalitsek, and Matlipekoagh — descended from heaven and created every thing, after which they returned. Masmasalanigh and the raven are said to be identical, and all his works originated in Yulatimot's mind. The same tradition is found among the Heiltsuk. Though they speak a dialect of the Kwakiutl, their customs and their belief are closely allied to those of the Bilhula. They say that two men, Masmasalanigh and Noakaua, descended from heaven and created every thing. Similarly the Qomoks, who belong to the Selish family, have adopted a great number of traditions and customs of the Kwakiutl.

The most important of these is the cannibalism connected with the winter dances. The custom prevails among the Kwakiutl, Tsimpshian, Bilhula, and Qomoks, and is said by some natives to be practised by the Tlingit. According to the Kwakiutl tradition, one of their ancestors descended from heaven, wearing a ring of red-cedar bark, and taught people the cannibal ceremonies. The Tsimpshian tell of a man who, in pursuit of a bear, came to a mountain that closed upon him. In the interior he learned the dances connected with the cannibal ceremonies, and taught them to his tribe after his return. This custom has evidently been adopted only by the Bilhula, as none of the Selish tribes except the Qomoks practise it. The latter have adopted only part of the ceremonies, and replace the terrible practice of devouring corpses by eating artificial ones, that are made by sewing dried halibut to a human skeleton.

Among the northern tribes originated the use of the well-known copper plates, which are highly prized, and which increase in value the more frequently they change their proprietor, and the longer their history is. They became known to the Bilhula quite recently, and I am told by old natives that they have never been in use among the Indians at the mouth of Fraser River.

There is a remarkable difference between the social institutions of the Tsimpshian, Tlingit, and Haida, and those of the rest of the tribes. Among the former the children belong to the gens to which the mother belongs: among the latter they follow the father's gens. This fact indicates a close connection between the Kwakiutl and Selish tribes; and, as a consideration of the languages shows some affinity of the two peoples, it is possible that the Kwakiutl are a remote branch of the Selish stock. The animal crest which prevails in the north is not found among the southern tribes. Their gentes derive their origin from a fabulous being which descended from heaven dressed in a bird's skin or in the shape of a man. Members of one gens are not allowed to intermarry, but have to take their wife or husband from another gens. In some of the tribes there are as many as from fifteen to twenty gentes.

Every tribe owns its district for fishing and hunting purposes and for gathering berries. Inside the boundaries of the tribe, each family has its own claim to certain rivers and parts of the coast, which they derive from their ancestor; but we are far from knowing the actual distribution of tribes and gentes. Even their number and names are still doubtful in many of the districts.

The common culture which extends over tribes of a great number of linguistic stocks of the north-west coast is one of the most attractive problems of American ethnology, and one deserving a thorough study. However, the ethnological character of these Indians is disappearing rapidly through their permanent contact with the whites; and within a few years it will be too late to collect the vast material that may readily be gathered at the present time. Puget Sound, the Selish of the interior, the Tsimpshian, are actually unknown, and an explorer may glean ample results by visiting some of these tribes, and contribute new and valuable material to American ethnology.

LONDON LETTER.

THE theory of Prof. G. H. Darwin, enunciated in a recent number of the *Fortnightly review*, that the actual origin of earthquake-shocks is usually to be traced below the bed of the sea not far from the coast, will probably receive a certain amount of confirmation when all the observations on the recent earthquake in the Riviera are collated and discussed. The steamship Carina, of Cardiff, off Savona, on the morning of the fatal Wednesday,


MAP
SHOWING THE DISTRIBUTION OF IND
ON THE COAST OF
BRITISH COLU
BY
DR. F. BOAS
I. Tsimpshian Family
II. Kwakiutl Family
Heiltsuk
Kwakiutl
Lekwiltok
III. West Vancouver Family
IV. Selish Fa
1. Bill
2. Coa
Qomoks
Pentlatsh
Sishiatl
Skoamish
Qauitsin
Lqungen
BILHULA
TSIMPSHIAN
HEILTSUK
KWAKIUTL
LEKWILTOK
QOMOKS
SISHIATL
PENTLATSH
Scale
1:2,500,000
129°
128°
127°
126°
125°
124°
53°
52°
51°
50°
49°


MAP
SHOWING THE DISTRIBUTION OF INDIAN LANGUAGES
ON THE COAST OF
BRITISH COLUMBIA
BY
DR. F. BOAS
I. Tsimpshian Family
II. Kwakiutl Family
Heiltsuk
Kwakiutl
Lekwiltok
III. West Vancouver Family
IV. Selish Family
1. Bilhula
2. Coast Selish
Qomoks
Pentlatsh
Sishiatl
Skoamish
Qauitsin
Lqungen
Simiamo
Tlalam
Lummi
Skagit
Snohomish
BILHULA
KWAKIUTL
LEKWILTOK
QOMOKS
SISHIATL
SKOAMISH
PENTLATSH
QAUITSIN
SIMIAMO
LUMMI
LQUNGEN
SKAGIT
TLALAM
127°
126°
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124°
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52°
51°
50°
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experienced a terrible motion for three or four minutes, as though the propellor had dropped off and the engines were racing terribly. Several fishermen, having noticed on the previous night unusual movements of the water on the shore-line, were afraid to go on shore to sleep.

The Lords' committee of council on education have just taken a new departure in the use of the South Kensington museum, library, and schools. Arrangements have been made for the study there, without any fees, for periods of from two to nine months, of persons engaged in those industries in which art is more or less concerned, the sole condition being that the proprietors of works in whose employ such students are, shall undertake to maintain them while they are thus engaged in studying. We trust that this is only a prelude to the employment of the science schools of the department in a similar way.

An active discussion is going on in the University of Cambridge as to the arrangement of specimens to be adopted in the new geological museum, which has yet to be built, and the site of which is still undecided. Professor Hughes heads the party which desires the stratigraphical arrangement, so as to present the earth's development at different epochs. The other party, led by Professor Newton, advocates the zoölogical arrangement, so as to display the development of particular orders of plants and animals ; and, with this view, it desires that the new museum should be placed as close as possible to the Museum of comparative anatomy, so as to facilitate a comparison of existing types.

A year ago, Professor Langley, the distinguished American astronomer, performed an experiment in the theatre of the Royal institution to explain his theory that the true color of the sun was blue. A few nights ago, in a lecture upon 'Sunlight colors,' Captain Abney repeated this experiment, adopting Professor Langley's figures, but dispensing with his paper disks, which, he held, vitiated the result. As the result of this, he maintained that the color of the sun was very nearly that of white light seen at high elevations in a clear, dust-free atmosphere. When the spectra of sunlight on the Alps and the spectra as imagined by Professor Langley were compared, they were almost identical. In support of some of his views, Captain Abney showed a novel and beautiful experiment, called an 'artificial sunset.' Through a solution of sodium hyposulphite, a clear circle of electric light was thrown on a screen : a few drops of hydrochloric acid added to the solution precipitated the sulphur in fine particles, and first the violet, and then the blue, green, and yellow rays were successively cut off, until finally there was the dull red of the sun setting in a wintry or a smoky sky. The effects of clearness of atmosphere on photographs were strikingly shown in Alpine and Egyptian pictures.

A serious outbreak of anthrax, or splenic-fever, recently occurred near Chelmsford, Essex, and it has communicated itself to several human subjects. Anthrax has long been known to be synonymous with that fatal human ailment 'wool-sorters' disease.' In one of the present cases a veterinary surgeon bled one of the animals, and some of the blood fell upon his shirt-sleeve. A pimple upon his arm was rubbed or scratched, and, the tiny raw spot touching the blood-stained sleeve, an unhappily successful inoculation was effected. Various possible causes of the outbreak are speculatively assigned, one being the feeding with pollard made from foreign corn.

The board of trade have appointed a committee to inquire into and report upon the desirability of electrical communication between lightships and the shore, with the special object of facilitating the saving of life at sea.

Sir Fred. Abel, the organizing secretary to the 'imperial institute,' designed to commemorate the jubilee of the reign of Queen Victoria, has addressed letters to the presidents and councils of several of the scientific societies, with a view of obtaining subscriptions to the scheme through those channels. Invitations to members to subscribe thereto have accordingly been issued by most of these bodies. Besides the institute fund, the Society of telegraph engineers appeals for separate subscriptions towards a telegraph jubilee fund, to be devoted to an entirely distinct purpose.

It is stated on excellent authority that a new and cheap insulating material and system of laying underground telegraph-wires has just been devised by Messrs. Callender & Co. of London and New York, by which a hitherto unapproachable speed of signalling can be obtained on underground lines. If what is stated be correct (and there seems no reason to doubt it), the problem which has occupied some of our best electricians for some years has been successfully solved.

A movement is on foot to obtain government aid for the various 'university colleges' in the larger English towns. Similar colleges in Ireland and Scotland have long received such aid, and very recently three Welsh colleges have obtained grants of twenty thousand dollars per year each. The English colleges (in Manchester, Newcastle, Bristol, Birmingham, Liverpool, Leeds, etc.) are entirely without such help, and in some cases, notably in Bristol, they are in serious pecuniary

embarrassment. The excellent character of the scientific work done in many of them is justly adduced as a reason for the request.

Prof. A. W. Williamson, F.R.S., has just resigned the chair of chemistry at University college, London. W.

London, March 7.

GEOGRAPHICAL NOTES.

Africa.

J. T. Last, commander of the London geographical society expedition to the Namuli Hills in East Africa, has sent a report of his trip to the south end of Lake Nyassa. Some of his remarks are of general interest. Starting from the mission station at Blantyre, he passed by Lake Shirwa, ascended Mount Zomba, which he found to be five thousand feet high, and visited the country of the Angoni, south-west of Lake Nyassa. He states that the district around Zomba proves to be very fertile. The English plantations in that district have fine crops of coffee. The culture of tea, cocoa, and arrowroot is being tried, and they promise to do well. On his way north he crossed the Shire, the eastern bank of which is quite uninhabited, while the western one is well-peopled and very fertile. As the kings of the Angoni and Yao — which latter live on the Shire — have made some terms of friendship, the petty wars between the tribes have ceased, and Last travelled without any trouble arising from this source. At the outlet of the Nyassa he encountered a low and sandy country with numerous patches that are covered with water during the wet season, salt being deposited when the water evaporates. The Angoni district, south-west of the Nyassa, forms a large plateau about five thousand feet high, which extends far west. In all this district there is scarcely a tree to be seen, and the fuel commonly used by the people is cornstalks and ox-dung. The land near the east is very poor, but as one proceeds towards the west it greatly improves in appearance, and in its western portions it is extensively cultivated. The expedition returned to Blantyre on the 1st of July. On the 12th they left again, and arrived at the Namuli Hills in August.

The Spanish traveller Sorela Fajardo arrived on the Senegal on Feb. 27. He proposes to cross the continent from west to east, starting from St. Louis in Senegambia.

America.

N. S. Shaler discusses in his paper on 'Fluviatile swamps of New England' (*Amer. journ. sc.*, March, 1887) the formation of river-valleys in New England, more particularly in eastern Massachusetts. A comparison between the rivers flowing north and those running south shows a great difference in the character of their valleys. The former have excavated the glacial deposits which filled their valleys, and deposited alluvial plains that have distinct terraces. The erosion of the old deposits is still continuing. The rivers running south have excavated part of their glacial deposits, but the process ceased a long time since. None of them have sufficiently strong current to clear their beds from the detritus carried into them by floods from their tributaries, and coarse sediments are continually being deposited in their valleys. Shaler supposes that these plains were formed while the river was at a lower level than it is at present, and became swampy by the same changes on the drainage conditions which have so obstructed the flow of the stream. These facts tend to show that the northern slope of the valleys has been diminished. Thus the eroding force of the rivers which run south has increased, while that of those running north has so much decreased as to stop their eroding action. Shaler estimates the tilting of the land necessary to have this effect to be two feet to the mile, and concludes, from the well-known observations on submerged forests on the New England coast, that it consisted in a lowering of the southern part. The result of his researches as to the recent geological history of this district are that the uneven glacial banks were deposited while the land was submerged. When the ice retreated, a re-elevation took place, after which the glacial deposits were rapidly excavated. With the disappearance of the ice from the continent, the southern portion became lower again, and the latter movement produced the swampy character of the valleys of rivers running north by putting an end to the eroding action of their waters.

The Mississippi River commission has just issued a map of the alluvial valley of the Mississippi River from the head of St. Francis Basin (latitude 37° 20′ north) to the Gulf of Mexico, showing lands subject to overflow, the location of levees, and trans-alluvial profiles, on a scale of five miles to an inch (1:316,800). The topography is reduced from detail maps and surveys made by the various government offices and railroads. The object of the map being to illustrate the floods of the Mississippi, the district which is subject to overflow is marked by brown hachure lines, the hydrography and lettering being printed in black. A great number of section-lines and the profiles belonging to them are embodied in the map. The profiles show the high-water line of 1882. Though these profiles are of a darker brown than that of the district subject to inundation, they somewhat dis-

tract the attention from the outlines of those districts. However, the additional information contained in the profiles fully makes up for this disadvantage, particularly as the map is on a large scale, and intended for a special study of the hydrography of the Mississippi.

An advance copy of a geological map of the northern part of the Dominion of Canada, by George M. Dawson, has been received. It embraces arctic America from latitude 60° north, and the adjoining parts of British Columbia and Labrador. The geological coloring is based on the explorations of the geological survey of Canada and on other authorities. The geological structure of the district west of the Mackenzie is still unknown. The most interesting parts of the map are the carboniferous area of the Parry Archipelago, which stretches from the outlet of Robeson Channel into the Arctic Ocean to Banks Land; and the adjoining Devonian and Silurian belt, which stretches in a continuous line from the east coast of Kane Basin to Hayes Sound, North Devon, and the Mackenzie River. The close connection between the geological structure of Grinnell Land and Parry Archipelago is very interesting. Its existence makes the exploration of the unknown area between those islands very desirable. Every thing tends to show that it is probably occupied by a group of islands, and therefore it is probable that an exploration might be accomplished without great difficulty or danger. The field for arctic explorers is not to be looked for only in the extreme north: the unknown districts which are comparatively easily reached deserve as much attention. Another interesting point of the map is the Devonian or Silurian basin of Fox Channel and Baffin Land, and that of Hudson Bay. It would have been desirable to have what little there is known of the orography of arctic America in this map, as it would help to give a clearer idea of the geological character of those districts.

The boundary between Venezuela and Brazil was surveyed in the years 1880 to 1883. The report of the work of the joint commissions has been prepared by the chief of the Brazilian commission, Lieut.-Col. Francisco Xavier Lopez de Araujo, and is printed in the Brazilian parliamentary papers (Rio de Janeiro, 1884). The map which accompanies this report contains much new information. The exploration of the Maturaca revealed the fact that the Orinoco and Rio Negro are not connected by the Cassiquiare alone, but that a great number of bifurcations exist which form a large island that has been named 'Ilha Pedro II.' On the subsequent journeys the river Padauiry and the Serra Curupica were explored. The expedition did not visit the district inhabited by the Maracañas and Kirishanas, who do not allow the whites to enter their territory.

NOTES AND NEWS.

WE learn from *Modern language notes* that the English folk-lore society has invited Prof. T. F. Crane of Cornell university to edit for the society the *exempla*, or illustrative stories of Jacques de Vitry, bishop of Acre, and historian of the Crusades. This compliment to American scholarship is specially marked, because Professor Crane was intrusted with the work with no limitations whatsoever. The *Athenaeum* adds, that these stories are about three hundred in number, and are contained in the hitherto inedited manuscripts No. 17509, Bibliothèque nationale, Paris. They are of great value for the question as to the diffusion of popular tales. They contain every variety of story, from the jest to the *conte dévot*, and are especially rich in fables, among them the oldest European version of 'The milkmaid and the pot of milk.' Professor Crane's edition will consist of an introduction on the life of Jacques de Vitry and the use of *exempla* in mediaeval sermons, the Latin text, and a brief translation or analysis in English, with comparative notes. It will probably be ready by the end of the year.

— The dome for the Lick observatory is well under way at the Union iron-works in San Francisco. It is 70 feet in diameter, will weigh 90 tons, and is to be revolved with a pressure of 135 pounds. The cost of the dome is $56,800.

— The daily papers recently announced the startling discovery that the earth had been retarded in its daily revolution ten minutes and eleven seconds between Feb. 25 and March 3, 1886, and anxious inquiries were made as to the causes and effects of this slowing-down. We are a little surprised that this absurd story comes, not from a wild theorist with unbounded faith in the maxim that figures will not lie, but from a practical man, "taking observations of the sun in his business of regulating and adjusting chronometers for masters of vessels arriving at Wilmington"!

— Dr. Peters of the Hamilton college observatory has given the small planet, No. 264, which he discovered on the 17th of December, the name Libussa. No. 256, discovered by Dr. Palisa, has been named Walpurga. A new asteroid, 265, was discovered by Palisa at Vienna on Feb. 27.

— The lectures under the auspices of the philosophical, anthropological, and biological societies of Washington are announced as follows: March 12, Gen. A. W. Greely, U.S.A., Animals of the

arctic regions; March 19, Capt. C. E. Dutton, U.S.A., Earthquakes; March 23, W. J. McGee, The Charleston earthquake; March 26, Prof. Otis T. Mason, The natural history of human arts; April 2, Dr. B. E. Fernow, Our forestry problem; April 6, Thomas Wilson, Prehistoric man in western Europe.

— Prof. J. R. Dodge, statistician of the agricultural department, has been appointed an official delegate to the international statistical institute which is to meet in Rome, April 11.

— An account of the foundation and work of the Blue Hill meteorological observatory, near Boston, has lately been prepared by its proprietor, Mr. A. Lawrence Rotch. Its records were begun the last of January, 1885; and especially in the second year of their sequence, when the difficulties and interruptions characteristic of their beginning had decreased, they are remarkably elaborate and complete. Very few stations in the country possess so extensive a set of self-recording apparatus. Local weather-prediction has been successfully attempted, the data being in part local observation, in part general observations of the signal service. For the past month or two, the predictions issued from the Hill have been regularly published in some of the Boston papers. Such an experiment, giving opportunity of comparing predictions made at a local and at a central (Washington) office, are of value, and should be undertaken and published by observant meteorologists in other parts of the country. The observers at Blue Hill — Mr. W. P. Gerrish for the first year, and Mr. H. H. Clayton for the second — have had some rather severe experience. Perhaps the most severe spell of weather was in the latter days of February, 1886, during a persistent north-west gale. The wind maintained a velocity of seventy-three miles for an hour on the 28th; the pressure recorded during short gusts of wind indicated a temporary velocity at the rate of ninety-three miles an hour. The total wind-movement on the 28th was 1,467 miles; for the last three days of February it was 3,735 miles. The ice-storm of the end of January, 1886, incased the hill, trees, building, and external instruments in a heavy sheathing of ice: the telephone-wire had a girth of eight inches. At this time, frost-work, such as characterizes Mount Washington and the Brocken, attained a length of one or two inches.

— Prof. Ernst Haeckel of Jena has been studying the lower forms of aninal life in the Levant this winter.

— Prof. Alexander Agassiz, director of the museum of zoölogy at Harvard, has been made a D.Sc. by the University of Cambridge. In introducing him, the public orator referred to him as one of whose work it might be said, '*Merses profundo, pulchrior evenit.*' The allusion was to Professor Agassiz' investigations of the mysteries of the ocean.

— The first comptroller of the treasury has decided that the act establishing agricultural experiment-stations in connection with the agricultural colleges of the several states and territories makes no appropriation for the purpose of the act, but that such appropriation, according to the terms of the act, must be "specially provided for by congress in the appropriations from year to year." The operation of the act is therefore practically suspended until congress takes some further action.

— On Feb. 22, 1888, the birthday of Arthur Schopenhauer will be celebrated in Germany with much ceremony by the followers of the pessimistic philosophy.

— The *Athenaeum* reports that Professer Du-Bois-Reymond will celebrate this year the twentieth anniversary of his appointment as secretary of the Academy of sciences of Berlin. He has held the post since 1867, and it has fallen to his lot to introduce into the academy a succession of the famous representatives of the modern sciences; among others, Helmholtz, Virchow, and Siemens. On such occasions he has given proof of his great talent as an orator, and Du Bois-Reymond's 'Begrüssungsrede' has become the feature of the introductions. He is the oldest member of the physico-mathematical class of the academy. His patent is dated March 5, 1851. The venerable French chemist, Chevreul, is the only member of older standing. Chevreul was enrolled in 1834.

— Mr. Lancaster, meteorological inspector at the Royal observatory at Brussels, has prepared a well-planned and compact summary of the climate of Belgium in 1886, including annual and monthly tables, barometric and thermometric curves, and a somewhat detailed account of the months separately. The winter beginning in December, 1885, is shown to have been persistently cold, although without extremely low temperatures. February, 1886, was very dry, and, as Lancaster has found usual in such cases, was followed by a drought of several months. He quotes seven examples since 1833, in which the precipitation for February was less than half the normal mean, all of which were succeeded by dry periods of from two to six months' duration.

— A curious example of minute observation, carefully carried out, appears in a note in *Ciel et*

terre for Jan. 1. It is on the relation of the state of the weather to the distance at which church-bells may be heard, by P. J. DeRidder of Lebbeke in Belgium, who kept a record of the church-bells and the weather from 1870 to 1882. He finds that the sounds are heard farthest when the movement of the air is cyclonic, or, if calm, when the air is very moist: sometimes contrary winds make no obstacle to sound-transmission. Sounds are heard at the greatest distance between one and two o'clock in the morning. Certain clocks, situated six and eight kilometres south-west of Lebbeke, are called *waterklokken* by the country-folk, because a rainy period always sets in soon after they are heard.

— Dr. Bowditch reports a case of lead-poisoning in which the only discoverable source of the lead was the solder used in the kettle in which water was boiled.

— Messrs. Nicholls and Bailey recently contributed to *Nature* the results of a series of observations made by them to test the acuteness of smell in the different sexes and in different individuals. The sense of smell in the male was found to be more acute, on the average, than in the female sex. In some individuals it was so keen as to detect one part of prussic acid in two million parts of water. Several substances were experimented with, and the following is a summary of the results, the figures indicating the average limit of delicacy of perception: — Cloves: males, 1 in 88,-128; females, 1 in 50,667. Nitrite of amyl: males, 1 in 783,370; females, 1 in 311,330. Extract of garlic: males, 1 in 57,927; females, 1 in 43,900. Bromine: males, 1 in 49,254; females, 1 in 16,244. Prussic acid: males, 1 in 112,000; females, 1 in 18,000.

— At a recent meeting of the Paris biological society, M. Gréhaut read a paper on 'The prevention of accidents from suffocation while descending into wells.' After referring to the cause of the suffocation, namely, carbonic-acid gas, and the well-known expedient of first lowering an animal into the well, he gives the following directions for ventilation: a stove-pipe ten or twelve feet longer than the well is deep is to be secured by wires in the axis of the well; a grate on which a fire can be built is then to be placed around this pipe at the level of the ground; and a second pipe, larger than the first, is then to be placed upon the grate, with the first pipe inside; and on the grate, and between the two pipes, a fire is to be built. The inner pipe being heated, a current is created, resulting in the ascent of the impure air of the well, and its replacement by fresh air from without.

— The following course of lectures is now in progress at De Pauw university: March 8, 'The earth,' Pres. T. C. Mendenhall, Rose polytechnic institute; March 14, 'The germ-theory of disease,' Prof. J. M. Coulter, Wabash college; April 4, 'Glaciers, past and present,' Prof. O. P. Jenkins, DePauw university; April 11, 'Charles Darwin,' Pres. D. S. Jordan, Indiana university; April 18, 'A beam of light,' Prof. J. B. DeMotte, DePauw university; April 25, 'Spectrum analysis,' Prof. P. S. Baker, DePauw university; May 2, 'The sun,' Prof. J. P. D. John, DePauw university.

— Summer courses are offered by Harvard college in chemistry, physics, botany, and geology.

— A very interesting philosophical work, by Prof. George T. Ladd of Yale, will shortly be published. It is entitled 'Physiological psychology,' and will be especially important just at this time, because, if our understanding of its scope and method is correct, it will maintain a philosophical and psychological stand-point, while admitting to their proper place the conclusions reached by physiology respecting the nature and functions of the nervous system. President McCosh's book on the 'Motive powers' is also nearly ready.

— The Turkish government has under public examination and supervision a large school for living languages. The British government is considering the expediency of imitating the example of the Turk, and a plan for the establishment of such an institution is shortly to be brought before parliament.

— The council of the Geological society awarded the medals at the anniversary meeting of the society on the 18th of February as follows: the Wollaston gold medal to Mr. J. W. Hulke, F.R.S.; the Murchison medal to the Rev. P. B. Brodie; the Lyell medal to Mr. S. Allport; and the Bigsby gold medal to Prof. C. Lapworth. The balances of the funds at the disposal of the society are awarded as follows: the Wollaston fund to Mr. B. N. Peach; the Murchison fund to Mr. R. Kidston; and the Lyell fund to the Rev. Osmond Fisher.

— In noticing the tenth report of the Historical manuscripts commission, the *Athenaeum* reviewer says, "The latest publication of the manuscripts commission is an excellent example of the method of modern historical research. The national school of history which flourishes under the direction of the master of the rolls is notoriously engaged in the collection of every well-authenticated scrap of manuscript material that is capable of illustrating some epoch or incident of English history. In this respect it has, perhaps,

set an example which is being eagerly followed by the historical bodies of most European countries. Germany, indeed, is, as well as America, already ahead of us in scientific methods of collecting and editing the more modern and political materials which may be gleaned from the archives of every state-paper office in Europe; while France, Austria, Belgium, and Sweden tread closely on our heels. The objects of modern history, therefore, though professedly national, are in fact cosmopolitan, each country opening up at times unexpected manuscript treasures for the more particular advantage of the other. Hitherto we have been content to rely chiefly upon the resources of our unrivalled national records; but every year affords fresh evidence of the extent and value of the outlying manuscript material which it is the special mission of the Historical manuscripts commission to incorporate with the main stock."

— Our retinal insensibility to the ultra-violet and infra-red rays has been recently discussed by Drs. Fox and Gould in the *American journal of ophthalmology*. The sufficient reason for the perception of the so-called 'light' rays is because the eye has learned to react to the strongest and most constant stimulus, and to extinguish or exclude those vibrations that would only confuse by their weakness or inconstancy, or that would with difficulty be focused with the rest. As to the range of vision along the spectrum, the remarkable fact is, not its narrow limits, but its extension. The marvel is that we have learned to see the violet rays at all, when they are so weak. The limit at the red end of the series is thought to be determined by the great absorption gap in the spectrum that separates the visible from the infra-red rays. It is then asked, how are the invisible rays excluded from stimulating the nerves? and although no satisfactory or final answer can be given, based on experiment, it is made at least probable that they are absorbed by the media of the eye before they reach the retina.

LETTERS TO THE EDITOR.

****Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

A sensitive wind-vane.

AN interesting discussion of this question has recently been initiated, and it may be well to give a portion of this and a few considerations bearing on the problem. I have seen it stated that a flat vane is always in a neutral line, and a sensitive one is made by fastening two plates together at an angle of about ten degrees. This statement has always appeared chimerical to me, for the reason that such a vane as described would have twice the weight and friction of a flat vane, and hence could not be as sensitive as the latter. We should gain, at the outset, a clear definition of what is meant by a sensitive vane. A very light structure, like a feather attached to a cord or balanced near one end, while tossed hither and yon by every breath, and exceedingly sensitive, could hardly be what is meant. I would say, as a first idea, that a sensitive vane is one that most readily assumes the wind-direction.

Professor Ferrel has discussed this question, from a mathematical stand-point, in the February number of the *American meteorological journal*. He assumes that the gyratory force (gy) of the wind upon a double-tailed vane varies as the square of the sine of one-half the angle between the tails, and gives the following expressions for the gyratory force. Let i = one-half the angle of tails, e = angle of deviation of wind, and F = wind-force upon unit surface of vane: then we shall have, with $i > e$, $gy = F \sin 2i \sin 2e$; with $i < e$, $gy = F \sin^2 (i + e)$ in the case of a double-tailed vane, and $gy = F \sin^2 e$ with a flat vane. Professor Ferrel finds, that, with $2i = 90°$, there is a maximum sensitiveness of the vane. Without entering upon a discussion of the theory developed by Professor Ferrel, it may be suggested that we cannot neglect the great pressure that the tails at an angle of 90° would have to bear in a high wind, and which would come upon the axis. This amounts to ten pounds per square foot in a wind, forty miles per hour, impinging normally upon a surface. The angle of the sides being 45°, the total pressure would be somewhat less, but would still be sufficient to prevent all free action of the vane.

Mr. G. E. Curtis has also very recently given a theoretical discussion of the question before the Washington philosophical society, and in this he differs very materially from the one just given. He assumes that the action of the wind varies as the sine of its deviation angle. He gives for vane with double tails, $gy = F \sin (i + e)$ when $i > e$, and $gy = 2F \sin i \cos e$ when $i < e$; for a flat vane, $gy = F \sin i$. In the original formula F is omitted; but I have supplied it, as it seems necessary. The notation is the same as in the previous case. There is a remarkable variance in these theoretical results, and it is a little difficult to state which is the more satisfactory. I hardly think that either can be accepted by the working meteorologist; but probably Professor Ferrel's is the more satisfactory, certainly for light winds.

No attention is paid in either of these discussions to the weight or friction of the vanes, yet it would seem as though either one of these is a far more important element than a single or double tail. In the discussion by Mr. Curtis we may very readily take these factors into account by placing the two tails of his double-tailed vane one above the other, edge to edge. We now have a flat vane whose weight, friction, and all other essentials are the same practically as those of the double-tailed vane; in fact, simply a transformation of the latter, without alteration except in the matter of surface. In fact, both vanes are directly comparable, while they were not before. We have, however, just doubled the surface of the flat vane, so that $gy = 2F \sin i$. Now, it is very easy to see that this expression has a greater value than $F \sin (i + e)$ when $i > e$, and also greater than $2F \sin i \cos e$ when $i < e$. This theoretical discussion, then, by Mr. Curtis, shows conclusively that the flat vane is the more sensitive. When we consider that Professor Ferrel regards the flat vane as much the steadier of the two, also that the

expense of manufacture and material is much less, it would seem as though it should be adopted, and attention turned to the weight, friction, shape of surface, etc.

Complaint is made of short, light vanes, that they often make a complete revolution in high winds. This could be obviated by increasing the weight, but this would not be as satisfactory as increasing the length. It is very evident that the same vane will not answer for both light and heavy winds. It would seem as though a long flat vane would do for the higher winds; and the lighter winds may be determined by the motion of smoke or a light banner, always being careful to keep the line of sight at right angles to the wind. This question is an eminently practical one. Experiments are much needed to determine the most satisfactory size of surface, length and weight of vane, for winds of different velocities, to satisfy the conditions first laid down.

Since writing the above, it has been suggested to me that the double vane can be so readily braced, it can be made out of very light material, and hence may be much lighter than the flat vane. The fallacy here consists in the implication that a single vane needs any bracing at all. Since there is no strain upon a flat vane, as it always turns immediately into the air-current, it need not be very stiff; but it is far otherwise with the double vane. Here the spreading of the tails at once brings a tendency to collapse, to each tail, which increases with the wind-velocity, and is never absent, being greatest when the vane is in the air-current. Each tail, then, must be far stiffer than the single tail, which has no strain at any time. But this is not all: the material used in the bracing will add much to the weight, especially with the greater angles of the tails. For example: take the most sensitive vane, where $2i = 90°$ and $e = 45°$. If the tails are 4 feet long, the spread at the tips will be 5.6 feet. A width of half a foot would give a strain of 30 pounds, with a wind-velocity of 40 miles per hour, and the tails must be very stiff. In addition, if the web bracing is as stiff as the tails, the total weight would be more than four times that of a single vane with double the surface and better fitted for service. H. ALLEN.

Philadelphia, March 15.

On certain electrical phenomena.

There are a few mystics in science (I am not one of them), but I fail, even upon a second reading, to discover that shroud of mystery enveloping my letter 'On certain electrical phenomena' (*Science*, No. 211), which seems to have impressed my critic, 'T. C. M.,' in a subsequent issue (No. 213).

My letter was copied into a number of the daily papers in the eastern and western cities, and I have letters from people who are strangers to me, in regard to it; but thus far, excepting 'T. C. M.,' no one seems to think it 'mysterious.' I am sure I did not when I wrote the account.

Your correspondent furcher advises me that I should 'possibly eliminate a few of the facts' in making such investigations, to which I can only reply that I am not in the habit of eliminating any of the facts in the premises of any scientific investigation I may be engaged in, whatsoever may be its character. Usually I gather and use all such *facts* as I can lay my hands on.

As the point is an important one, I would also like to say to Professor Mendenhall that he evidently misquotes me in the next paragraph of his letter, wherein he says that "Dr. Shufeldt states that he had never observed such exhibitions in Washington." I made no such statement, but did remark that "I had never observed (there) such exhibitions so far as my own person was concerned, and they only gradually developed at this place" (Fort Wingate, N. Mex.). The cases cited for that city by him are very interesting.

I repeat, that in my case the "electrical discharge was considerably greater from the tip of the index-finger than from any of the others of the hand, and gradually diminished in regular order as we proceeded to the little finger;" and this after careful experimentation. I nowhere even imply that this will be found to be universally the case.

Further, your correspondent seems to hold the opinion that every one exhibits such electrical phenomena in the same degree, when submitted to similar conditions to excite it. In this I thoroughly disagree with him; for further experimentation here, goes to show that phenomena similar to those I described in my letter to *Science* are exhibited in varying degree by my three children, whereas on the other hand, in the case of the mulatto child I referred to, it has thus far, after numerous trials, been impossible to excite them in her.

And I must believe, that, when Professor Mendenhall comes to make more extended inquiry among a greater number of people, he will discover that there are many of them who have absolutely never heard of such things, to say nothing of having observed them in the case of their own persons. Common it is, no doubt; and, ah, me! how wise we would all be if we were but only thoroughly informed upon all common phenomena! R. W. SHUFELDT.

Fort Wingate, N. Mex., March 10.

Comparative taxation.

It is true, as Mr. Atkinson says, that it is easier to criticise than to construct, and Mr. Atkinson deserves credit for his undertaking. Yet criticism of what has already been done may be of value in clearing the way for more perfect work in the future, and I therefore venture to offer a further criticism of some of the views expressed in Mr. Atkinson's letter of March 4.

Mr. Atkinson gives, as a reason for considering national taxation separately, the fact that in Europe so large a portion of the national revenue is expended for '*destructive* purposes,' by which I suppose is meant war purposes. The difference between Europe and this country is not so great as most people probably believe. If we consider the army and navy and pensions, which are a war expenditure, we find that in 1885–86 the German empire expended for the above purposes $110,500,784, and the United States $111,636,903. A comparison of the relation of these expenditures to total expenditures in the two countries is rendered difficult by the different character of the governments; but considering only the ordinary governmental expenditures, that is, omitting the consideration of railways, mines, etc., we find that in the United States war expenditures amount to 39 per cent of the whole; in the German empire, exclusive of the individual states, to 77 per cent; and in Prussia and the empire taken together, to 28 per cent.

Prussia and the empire together would form a fairer basis for comparison with the United States than would the empire alone, because the latter leaves the civil administration almost entirely to the individual states. The comparison with Prussia and the empire together, however, would not be exact, as in Prussia the nation assumes some functions which are here left to the states; but it is safe to say, that, if we could compare with accuracy the expenditures for like purposes in Prussia and the empire together and in the United States, it would be found that the proportions in each of war expenditures were nearly the same; and of course, if we consider the *productive* expenditures of the German states, the percentage of war expenditures will be much smaller than in this country.

I do not mean to deny Mr. Atkinson's general statement that a larger proportion of expenditures goes for war purposes in Europe than in the United States, nor to underestimate the other burdens which a great standing army imposes, but merely to point out, that, so far as state expenditure for war purposes is concerned, the difference between this and other countries is not so great as we are apt to think, and that in the case of Germany it is doubtful if whatever difference there may be is in our favor.

Mr. Atkinson also holds "that the revenue of state forests, mines, and other instrumentalities of subsistence . . . constitute as true a tax upon the people as if they had been assessed directly on their property."

That is a question that ought to be determined before we begin to make comparisons. If we intend to count profits from lands, mines, and railroads as taxes in Europe, we must do so in this country.

If the consumer is served equally well and cheaply by a private and public producer, profits are no more a tax in one case than in the other. It would be difficult to convince any one that it makes no difference to the German tax-payer whether governments derive from the profits of railroads a revenue sufficient to pay the interest on the public debts, as is the case in the German states, or whether that revenue comes from taxation, provided the railroads are as well managed as they would be if government did not control them.

HENRY B. GARDNER.

Johns Hopkins univ., Baltimore, March 21.

The characteristic curves of composition.

With regard to Professor Mendenhall's novel paper on 'The characteristic curves of composition,' in your issue of March 11 (No. 214), which proposes to represent and compare the orthographical productions of writers by a statistical and graphical method, it seems to me, that, interesting and instructive as are the results he has reached, they are confined to a range of inquiry too narrow to bring into sufficient relief the personal idiosyncrasies of individual writers, and to a kind of enumeration in which personal peculiarities are too much marked by the particular language in which they write.

That the characteristic curve is principally controlled by the language in which the composition is written, is evident from the comparatively small difference to be found between the various English writers between whom comparison is made, as well as from the marked departure from this general shape of the English curve to be seen in that of Caesar's 'Commentaries.' The curve found for any other Latin author would presumably not differ from this one more than the curves of various English writers differ from each other.

What the general shape of the characteristic curve may be for any writer is determined, then, principally by the language in which he writes.

It would be interesting to compare several languages with each other, so as to obtain approximately the normal curve for each. An inflected language, like Greek, Latin, or German, will, of necessity, have its normal curve largely affected by the numerous letters forming the terminations. Moreover, any tendency toward the formation of compound words, such as *Pferdebahnwagon*, or toward agglutination, would also have its effect upon the shape of the curve. Such a comparison would doubtless furnish tests on which to build new arguments and comparisons respecting the vexed question of Teutonicity, and the like.

But to return to the point with which I began; viz., that there are other characteristics of writers equally susceptible of treatment by the statistical and graphical method, in which their personal peculiarities differ more widely, and which are therefore more characteristic than the habitual selection and use of long or short words. For example: it seems to me that the length of the sentences employed by a writer is such a peculiarity, and one which, although influenced somewhat by the particular language in which he writes, is nevertheless an expression of his habits, feeling, taste, and individuality to such an extent as to exhibit necessarily some characteristics which would distinguish him in a marked manner from other writers.

The length of the adjective modifiers of substantives seems also to be a particular well suited to bring out individual characteristics by a similar enumeration. In this category may be mentioned also the length of the adverbial expressions; the complexity of the verbs; as well as the character of the vocabulary as regards derivation from Anglo-Saxon, French, Latin, Greek, etc. The list of fit subjects of enumeration can be extended at will.

It would seem probable that a discussion of the results obtained by the simultaneous application of several of these enumerations would, in any case of disputed authorship, afford decisive tests such as could not be obtained from any one of them singly; and by its help the person making the investigation could exhibit to the public how weighty the evidence may be on which his judgment is based.

H. T. EDDY.

Cincinnati, March 14.

Earthquake weather at sea.

Your European exchanges have no doubt given you so full reports of the recent earthquake in this region, that it would be impossible for me to add any thing that would interest you or your readers. You may be interested, however, to have somewhat in as detail a report of earthquake weather at sea, such was encountered by the steamship Gottardo on its last trip from New York.

We sailed from New York on the 19th of February, and had disagreeable weather almost from the hour we left Sandy Hook. On Tuesday, the 23d, began a series of storms which kept by us almost constantly until we sighted the African coast outside the Straits of Gibraltar. The disturbance began about 4 P.M.

on that day, when we were in latitude 37° 32′ north, longitude 51° 26′ west of Greenwich. At that hour the barometer fell to 29.33; and the wind, which had been in the S.E., suddenly veered round to the S.W. and W. It increased in intensity very fast, and in an hour was blowing a whole gale, fully 70 knots an hour. The direction of the wind during this change was successively S.E., S.S.W., S.W., W., N.W., and N.N.W., and during the next twenty-four hours it was shifting back and forth from S.W. to N.N.W., with frequent squalls of hail and rain and a very heavy sea. The gale subsided the afternoon of the 24th, and the wind subsequent to the disturbance was quite steadily from the N.N.W.

The weather continued to be cloudy and squally, with frequent hail and rain and heavy sea; the barometer continued very low, and the wind strong from the N.N.W. and W.N.W., until the 27th, when the wind veered to the W. and S.W., and remained in that quarter until the Azores were passed.

Early on the 1st inst. the wind shifted to the S.E. and E., with strong and heavy sea, and remained a steady head-wind, with cloudy and squally weather, until we were within a hundred miles of Gibraltar, the night of the 4th inst. At Gibraltar we learned of the earthquakes hereabouts and in the south of France, and were satisfied, that, if we had escaped the shock of the earthquake, we had had our share of earthquake weather. How far experienced observers may be able to connect our remarkable atmospheric disturbances at sea with the almost simultaneous quakings on land, I will not venture to suggest, but leave with you the record as it was made up at sea before we knew any thing of what was taking place on land.

At Gibraltar we learned that the western Mediterranean had been exceedingly stormy during the week following the earthquake, and it will probably be found that the atmospheric disturbance corresponded closely with that which we experienced at sea.

HENRY D. HARROWER.

Genoa, Italy, March 9.

Notes on the diet of amblystomas.

All this past winter I have kept, in a little water in a small covered tin can, a large adult specimen of Amblystoma mavortium. Upon several occasions he has had the water about him freeze perfectly solid; and by accident he once remained in this condition, firmly fixed in the clear cake of ice, for a period of forty-eight hours. When spring came about, I removed him to a large and comfortable glass jar, with a heap of rocks in it for him to come out of the water and rest upon.

As he had not eaten any thing whatever for nearly five months, it struck me that he might have a good appetite for some raw meat. My suspicions were fully confirmed, for he ravenously devoured five pieces of lean beef in rapid succession, each piece being about as large as an ordinary lima bean.

Next day I could not get him to touch any thing, nor could he be tempted by the most delicate morsel of raw beef on the second day after his feast. The third day he seemed to me to be rather uneasy; and, believing him to be hungry again, I offered him a nice little piece of lean and raw mutton, as I had no beef. He at once snapped at it eagerly, taking the entire piece in his mouth. It was not there more than a fraction of a second, however, when his eyes began to roll in his head with a peculiarly horrified expression; and with a disgusted effort he immediately ejected the morsel of mutton again, and then took to spitting and gaping in a way that I never saw him guilty of before. There was no doubt in the world but that he was hungry; my several renewed efforts, however, to get him to eat the mutton, all failed.

So far as this individual specimen is concerned, he undoubtedly has a great aversion to that kind of meat, and it would be interesting to know whether this is merely 'a personal idiosyncrasy,' or whether it is universally the case. R. W. SHUFELDT.

Fort Wingate, N. Mex., March 14.

Old maps of the Great Lakes.

In looking over (for other purposes) some of the old maps in the congressional library, I have been struck with the confusion of ideas which seems to have prevailed among the early geographers on the subject of the drainage of the Great Lakes. Tracings of several are before me. One marked conjecturally on the original 'ab 1690' shows 'Lake Erius or Felis' connected by a good broad natural canal with the Potomac, which is represented as rising, at farthest, not much above the site of Washington. This is the harder to account for, inasmuch as the river-bank below, and the adjacent shore of Chesapeake Bay, were evidently well settled. Port Tobacco, Bristol, Calverton, St. Mary's, Arundelton, and Whitehall make a good sprinkling of villages, most of which have changed their names or passed away altogether; but a little beyond them all is twilight, with its illusions. So far as one can make out, the Anacostia or eastern branch is given the work of lake-drainage.

On a map of the world published in 1670 by Thornton of London, the Mississippi takes its rise in 'Grand Lake,' evidently Lake Superior. A map of America 'ab 1685' makes Lake Ontarius the source instead; and there is yet another, of which I made no note, that represents Lake Erius as discharging in the same manner and direction. All or nearly all of these geographers were aware of the St. Lawrence and its relations to the lake system, but they believed in a double drainage in very different directions.

A map ('ab 1690') of "New England, New York, New Iarsay, Pensilvania Maryland and Virginia, sold by Iohn Thornton at ye plass in ye minories" and others, is generally correct as to the outline of Chesapeake Bay and the tide-water part of the Potomac, but above the Little Falls it takes the name of Turkey Buzzard River. At no very great distance north of this point, this stream rises amid figures of trees and hills, with wild animals in the distance; but 'Lake Erius' is not called in to assist conjecture.

WM. H. BABCOCK.

Washington, D.C., March 10.

A meteorological inquiry.

Why do the winds at Denver blow either north or south nearly fifty per cent of the time, coming from the north during the day, and from the south by night? The record for 1884 shows twice as many south winds as north, but two observations are made at night to one during the day. H. A. HOWE.

Denver univ., March 2.

SCIENCE.—SUPPLEMENT.

FRIDAY, MARCH 25, 1887.

SCIENTIFIC PHRENOLOGY.

UNDER the above title the London *Times* reports an interesting session of the Anthropological institute, Mr. Francis Galton in the chair, at which Professor Ferrier read a paper on the 'Functional topography of the brain.' He discussed the question how far recent investigations into the functional topography of the brain could be brought into relation with craniological and anthropological researches with a view to establish the foundations of a scientific phrenology. Then he sketched the functional topography of the brain so far as it had been settled, but pointed out that the psychological aspects of brain-functions were still far from being made out, although that correlation must be established and proved before a practical psychology, in any degree serviceable to the physician or the anthropolo ist, could be regarded as possible. He offered some speculations on the subject, and illustrated them by reference to certain facts and phenomena of disease in man. On the question as to how far it was possible, from an anatomical examination of the brain, to form an estimate of the forces and capacities of the individual, he pointed out many great difficulties which had to be encountered. Not merely the size of parts had to be taken into account, but the relation of different regions to each other, the action of *metastasis*, structural differences, as well as other influences. *Caeteris paribus*, greater anatomical development might be considered as an index of greater functional capacity, all which points the lecturer illustrated in various ways. He thought the attempt to determine differences in functional capacity from the examination of the head involved all the difficulties connected with the examination of the brain, and a great many more. He indicated the cranial relations of the principal convolutions, but expressed his belief that in the present state of our knowledge the data of a scientific phrenology were still very deficient. There was reason to believe, however, that if the subject were taken up from different points of view by anatomists, physiologists, psychologists, and anthropologists, great progress might be made.

The discussion of the paper was opened by Sir James Crichton Browne, who detailed some very interesting electrical experiments he had made on the brain of a monkey, which clearly demonstrated localization of the cerebral functions. There were too often, however, insuperable difficulties to be met with in pursuing a parallel series of experiments on the living human brain. There were on record some curious accounts of investigations relative to the brain of a fowl by a bishop of Ratisbon in the thirteenth century, and in 'Burton's anatomy of melancholy' a good number of instances more or less like it were collected. It seemed to have been agreed that the number of the cerebral functions was thirty-five. To the early phrenologists a certain tribute of praise was due for their having, at least, called attention to the subject of craniological phenomena, although the quackeries of Professor Cagliostro and his rivals were simply beneath contempt. Boys were artfully trained to subserve the cunning exhibitions of such impostors. Still it must be allowed that the pseudo-phrenology in a certain sense paved the way for the cautious researches of the true science of a possibly distant future.

PSYCHOLOGICAL NOTES.

THE January issue of *Mind* contains an account of an interesting series of experiments on the limit of the capacity to repeat a series of sounds after hearing them read once. A German experimenter, Ebbinghaus, had studied the powers of the memory by counting the number of times a given series of nonsense-syllables had to be repeated in order to enable the hearer to reproduce them by rote. Mr. Joseph Jacobs (with the cooperation of Mr. Sully, Mr. Read, and Mrs. Bryant) has carried a similar means of testing the memory (or, as they more accurately call it, the 'prehension') into the school-room. The method was somewhat simpler. Instead of nonsense-syllables (for instance, *dak-mil-tak-bin-roz*), which are very disturbing, the names of the letters (omitting 'double *u*') and of the numerals (omitting 7) were chosen; and the maximum number of letters and numbers that a child could repeat after *one* reading was called its 'span.' Care was taken to pronounce the words as monotonously and as regularly as possible in order to avoid any assistance to the memory from a more or less decided rhythm. The numbers or letters were dictated to the class, each member of which then (usually) wrote down as accurately as possible the series of letters or numbers. The results thus reached were quite interesting.

The mental span increases quite constantly with the age. Boys of 11 years could grasp 6.5 numerals and 5.5 letters; of 12 years, 6.8 numerals and 5.7 letters; of 13 years, 8.8 numerals and 6.9 letters. The following table shows the result of a more extended set of observations on the girls of the North London collegiate school: —

Age	8	9	10	11	12	13	14	15	16	17	18	19
Number of subjects	8	13	19	36	41	42	42	72	66	50	30	14
Average number of numerals	6.6	6.7	6.8	7.2	7.4	7.3	7.3	7.7	8	8	8.6	8.6
Average number of letters	6	7	6 6	6.4	6.5	6.7	6.7	7.4	7.9	7.3	8.2	7.9

While the limit for numerals was, as a rule, higher than that for letters, cases when the reverse was true were not infrequent. In one set of 88 schoolboys, 14 could repeat more letters than numerals, while 33 of the remainder had the same limit for both. No definite conclusions can be drawn as to the relative spans of the two sexes, as the boys and girls came from different classes of society. It may be worth noting, that, at the age of 13, the boys could repeat 8.8 numerals to the girls' 8.3, but only 6.9 letters to the latter's 7.3.

A very clear result was, that the span bore a definite relation to the rank in the class. Thus, the 10 boys who stood highest among 30 twelve-year-olds had an average span for numerals of 9.1; while the middle 10 had only 8.3, and the lowest 10, 7.9; and the same holds for the girls. The first half of a class almost invariably shows a higher span, both for letters and for numerals, than the second half.

Mr. Francis Galton and Professor Bain applied a similar method of observation to the memory-powers of idiots. While most idiots can hardly add two figures together, some have a decided knack for remembering figures, dates, and so on. Nine of the best girl-idiots at an asylum (none of whom could add 3 to 5) had an average span for numerals of only 4. Two girls who could not repeat more than two figures without mistake were tested with three figures. In 23 trials the last figure was rightly repeated 17 times, the second 10 times, and the first 7 times, showing that the last-uttered sound is most readily repeated.

Idiots with peculiar memories were also tested. One could repeat pages of Maynall's 'History' with considerable exactness; another had a remarkable intimacy with the calendar. But they all failed on the numeral test, being hardly able to repeat three figures. Their memories seemed deeply rutted in one groove; not strong, but very limited.

The experiments on the idiots of another asylum showed a somewhat higher mental span, accompanied by a higher capacity generally.

In the same journal, Dr. J. M. Cattell records some 'Experiments on the association of ideas. His object is to measure the time needed for the characteristic processes of ordinary thinking. The experiments were made on himself and a German friend, Dr. Berger. A few of his results are these. To give the name of the picture of an object in a foreign language (English for a German, and German for an American) required .649 and .694 of a second respectively, which is .172 and .149 of a second longer than to name objects in one's own language.

Experiments on the time necessary for translating words showed that it took longer to translate from the foreign to the vernacular than the reverse, and also that the time itself might indicate one's familiarity with the two languages.

Given a city to name the country in which it is situated required about .400 of a second. Given a month to name the following month required .367 of a second, while to name the preceding month took as long as .798 of a second, showing how much more readily the mind moved forwards than backwards. Similarly, it is easier to proceed from the part to the whole than from the whole to the part. Given a month to name the appropriate season requires .363 of a second; given a season to name a month in it, .498 of a second.

When the association is less restricted, — as, for instance, to name a subject for an intransitive verb (*swim – fish*), or an object for a transitive one (*write – letter*), — the time is longer. The former operation took .646 of a second, and the latter .517, the mind moving logically towards the object.

The time necessary to judge the length of a line suddenly revealed was very long (nearly one second), showing that the judging process forms slowly.

It is, however, to be remembered that in all the above processes individual variations are extremely large. While such experiments are rather suggestive and personally interesting, they can hardly be said to have the scientific character or importance belonging to the measurement of more elementary processes. There is little guaranty that the process in different minds is sufficiently alike to make an average significant.

CURRENTS IN THE BOSPHORUS.

CAPTAIN MAKAROF of the Russian navy has given an account, in the Sapieski of the academy at St. Petersburg, of his observations on the currents of the Bosphorus, made between November, 1881, and August, 1882, which reaches us through the highly valued *Annalen der Hydrographie* of the German admiralty. The surface current, from the Black Sea to the Sea of Marmora, follows the windings of the strait, with occasional backset eddies near the shore: its velocity averages two knots an hour, and reaches a maximum of four knots. The velocity has a maximum in summer corresponding to the higher level of the Black Sea in that season and a faint maximum about noon, supposed to be due to the diurnal increase of the north-east wind. The undercurrent carries the denser water of the Mediterranean into the Black Sea: its water has a specific gravity of 1.02834, while that of the surface is 1.01534. The plane of contact of the two has a greater inclination towards the Black Sea: at Constantinople it is twenty metres under the surface; at the north-eastern end of the Bosphorus it is fifty metres deep. This is shown more in detail in the following table: —

Distance from Black Sea. Kilometres.	Contact plane. Metres.	Depth of water of sp.gr. 1.020.	Depth of water of sp. gr. 1.025.
0	50	45	49
9	43	39	42
20	36	33	37
23	42	25	27
29	20	25	24

There appears to be a variation in the depth of the contact plane with the seasons, but it is to be remembered that this depends on only one year's observations. At nine kilometres from the Black Sea, water of a specific gravity of 1.0225 was found in the middle of June at 43 metres; at the beginning of July, 41.5; end of July, 40.5; end of August, 34.7 metres. It is suggested that this variation depends on the height of the water in the Black Sea. The greater its height above that of the Sea of Marmora, the less the difference of pressure at the bottom of the strait, and thus the less cause for the deep counter-current. The velocity of the upper current is greatest at the surface; at the limit between the two currents, the two velocities just counteract each other; the maximum velocity of the lower stream is found at five and a half metres below this neutral surface. By considering the mean velocities and cross-sections of the two currents, it is estimated that the Bosphorus annually carries 152 cubic kilometres of water from the Black Sea.

MENTAL HYGIENE.

ONE important element that contributes to the high position that Germany occupies in the world of science is the existence of a large class of scientists devoted to a specialty, but with an intelligent and cultured interest in many topics lying more or less remotely outside their own branch. In this way an appreciative public is guaranteed for an 'atechnical' treatment (to use Hamerton's word) of one's own specialty. This is synonymous with the good sense of the word 'popular,' but it is the very opposite of much that goes by that name here. It is a concise and easy treatment of a subject, without neglecting the difficult points, or sifting out the interesting things to be served in a highly diluted form. Another enviable peculiarity of German science closely connected with the former is the ability to treat a subject from (there is no better word for it) a philosophic point of view; to bring it into relation with the questions that always have interested and always will interest mankind. As the physicians everywhere form the largest body of professional scientists, it is an especially enviable state of things when all this (as it is in Germany) is true of them. An excellent illustration of this fact is shown in this book by Dr. Schulz. He is writing upon his specialty in a perfectly clear and yet entirely scientific manner, feels confident of finding an appreciative public, and has shown an important connection between the teacher and the doctor.

The problem of civilization is to the alienist the problem of keeping sane. At no time was optimism so justifiable a faith as it is now. Comfort, liberty, philanthropy, education, and all the aids to happiness, are more wide-spread now than ever before. And yet we do not enjoy our happiness. Discontent is found everywhere. Why is this? Primitive man used muscle and nerve as his chief tools, just as we do; but formerly it was the muscle, now it is the nerve, that has the most to do. The work that modern culture demands is, above all, brain-work. The higher the civilization, the more the brain has to do. This delicate organ has become overtaxed. The onward march has been too rapid to give us time to get fully adapted to our surroundings, and an intense struggle for existence is the result. In this struggle many fail, and hence our age is called an 'age of nerves' (*nervöses Zeitalter*): hence the alarm-

Die Diätetik des Geistes. Von Dr. FRIEDERICH SCHULZ. Leipzig.

ing increase of nervous and mental diseases. Thus it is that the problem of keeping sane becomes the problem of civilization: civilization is the cause of mental weakness as well as the result of mental strength.

The two factors that have of late come into greatest prominence in this connection are the use of stimulants and the universal applicability of the laws of heredity. The fact that these come first is a sufficiently suggestive text to which the sermon can readily be added. Dr. Schulz looks forward to the time when these truths will be incorporated into social morality, and imprudent marriages be placed in the same category with criminality.

It is more true of nervous than of any other diseases, that the ideal to be aimed at is not so much to cure them as to prevent them. In the work of prevention it is the parent and the teacher who can do the most. The ancient phrase that calls the teacher the doctor of the mind is more than a metaphor. The doctor and the educator are at work upon the same problem. What the latter does is taking so much of a load from the shoulders of the former, and in the next generation the debt is repaid. And still more is this true of the parent. Our increased knowledge of nervous and mental diseases enables us to recognize their incipient stages when they can be checked from further development. That no one is perfectly sane is a commonplace. What it means is, that each one detects in himself latent tendencies in one direction or another, which, if they remain unchecked and are left to develop freely, would become morbid. A normal, rational life cures these tendencies of itself. They are absorbed in the growth of character. Yet it is very necessary to remember that our insane fellow-man is not made of different material from ourselves; he has simply elaborated one of the factors of life at the expense of all the others, and has thus lost his mental equilibrium: and it is also well for teachers to know as much of the nature of such tendencies as can be acquired from the reading of such a book as this.

The mental life of children presents problems peculiar to itself. We are beginning to take the step from the empirical to the scientific statement of these problems. We are learning to see things from the child's point of view; to appreciate how very intimate is its mental connection with its physical well-being; to know that education does not mean instruction; and, above all, the awful significance of that period of life when the boy or girl becomes a man or woman is recognized as the key to all higher character-building. Whatever may be said against the materialistic tendencies of our day in other directions, in the field of education it has introduced wonderful reforms. In the school-room it has banished the middle ages and rationalized methods.

Enough has probably been said to show the point of view from which mental unsoundness is treated in the works of which this is a good type. It is an anthropological study of brain-culture. It describes the morbid tendencies in mental development, and thus gives additional knowledge of the normal mind; and, finally, it brings the problems of modern civilization to a focus where they can be studied and practically thought out for the benefit of the races to come.

ECONOMICS, SCIENTIFIC AND POPULAR.

The economics of industry. By A. and M. P. MARSHALL. 3d ed. New York, Macmillan. 12°.

THE wide-spread interest in the prominent economical questions of the day has brought forth new editions of two English works which are in different ways most timely and useful. The 'Economics of industry' well deserves the honor of a third edition. As professing to solve the problem of distribution in a scientific manner, it is of course especially interesting in its bearing on the controversy now flagrant between the old and the new school of economic thought. The authors do not formally array themselves with either of the antagonists. By casting some of the most distinctive doctrines of the new school into a purely scientific form, they refute the charge that the modern theories remove economics from the category of sciences. On the other hand, they are far from rejecting the system and methods adopted by the great expounders of the old school. The purpose of the volume is expressly declared to be a completer development of the theory of value, wages, and profits as propounded by John Stuart Mill. It is well known that Mill was, of all the older school of economists, the least inclined to consider its conclusions absolute and final verity. Nothing could be more natural, therefore, than to use his work as the foundation for a more modern superstructure. Our authors contribute much, indeed, to the elucidation of the truth that the new economics, which its younger and more enthusiastic devotees are apt to hail as an inspired creation, is in reality only a growth. It is the flowering and the fruiting of the symmetrical but in many aspects repulsive stalk which has hitherto been all that the world could see of political economy.

The influence of the modern tendency manifests itself at the very outset by a broadening in the definition of the fundamental concepts of the science. Wealth, for example, is made to include

non-material possessions as well as the tangible utilities. A larger scope in the conception of capital is, of course, the necessary corollary. The ordinary analysis of capital is, furthermore, improved by the division into 'specialized' and 'non-specialized,' depending upon the degree of difficulty in diverting it from one trade to another; and convenience in phraseology is enhanced by distinguishing between 'remuneratory,' or 'wage-capital,' and 'auxiliary capital,' or that employed to aid the labor which the first supports. In such a spirit of broad definition and logical distinction, book i. of the 'Economics of industry' presents the ordinary doctrines of land, labor, and capital with clearness and conciseness.

Book ii. treats of normal value. Here, with most painstaking care, is elaborated the theory of value and the solution of the problem of distribution which especially distinguishes the modern economy. In the theory of value, the old lines are generally followed, save in the more or less important substitution of 'normal value' for the concept which has become familiar as 'natural value.' The discussion of distribution, however, reveals a departure from old standards at the very outset. Instead of the ancient assignment of the product of industry to the various classes of rent, profits, and wages, we find a division into rent, earnings, and interest. In accordance with a principle that is characteristic of the new school, the *entrepreneur* class is differentiated from the capitalists, and its share of the produce is grouped with the wages of labor rather than with the wages of abstinence. The law fixing the rate of interest is accordingly worked out as the sole determinant of the capitalist's share of a product, while the profits of the employer of labor are assimilated in treatment to the income of skilled wage-earners. The justice and logic of this arrangement cannot be questioned. The industrial revolution which began last century, and may not yet have culminated, has certainly evolved a new economical factor. As Walker says in his work on wages, "It is no longer true that a man becomes an employer because he is a capitalist. Men command capital because they have the qualifications to profitably employ labor. To these captains of industry (or organizers of industry), capital and labor alike resort for the opportunity to perform their several functions." The tendency of this class to increased importance is well illustrated by the demonstration of the principle that those who, with little or no capital, depend upon their business profits for a livelihood, undersell and drive out of trade those who, having capital, undertake the management of industry merely to increase their income (pp. 136, 137). Modern production has, in short, attained that stage where ability without capital has a much fairer hope of great rewards than capital without ability. It would be useful to have this fact instilled into the minds of the masses who are constantly complaining about the 'capitalists.' The chapter entitled 'Earnings of management,' in the book under review, contains a most admirable investigation of the nature and functions of the *entrepreneur* class.

It was to be expected that an author of modern economic propensities would touch up that *bête noir* of the new school, the wages-fund theory. We find this subject buried in the depths of the chapter on trades-unions. The authors are rather inclined to adopt the position of Mill in his later days as opposed to the bald doctrine of the extreme old school. Jevons and all the other lights of the new school throw themselves unreservedly upon the doctrine that wages and profits can increase simultaneously; in short, that the law of supply and demand operating in the respective classes determines wages of labor and wages of management. The Marshalls appear unwilling to go thus far; but they emphasize the idea that the efficiency of labor as well as the amount of antecedent capital exercises a potent influence upon wages. Trades-unions, they think, may enable laborers to obtain a general increase of wages, which, however, will only be permanent if attained by means that do not seriously hinder production, and if used in such a way as largely to increase at least the personal capital of the laborers, and so to add much to their efficiency (p. 203).

The wealth of households. Danson. Oxford, Clarendon pr. 12°.

In striking contrast with the scientific spirit that pervades the volume just discussed, is the air of breezy popularity that characterizes 'The wealth of households.' Why the author chose to disguise a treatise on political economy with such a title is an unsolved mystery. We hazard the conjecture that the reason might be found in the same trait of Mr. Danson's mind which has led him to turn the customary order of economic discussion all topsy-turvy, while not aiming at any novel result. His book was originally concocted for the benefit of his children. This probably explains the division of the text into numbered paragraphs of an average length, that suggests a second or possibly a third reader, and on a principle of logical connection that has no parallel outside of the authorized version of the Bible.

The intimation in the preface is not necessary to assure the reader that Mr. Danson has been a 'man of business.' Nor is it difficult to guess the special line he was in. The able, vigorous, and

reiterated defence of the usefulness of the 'dealer' or middleman in the economical structure of society might, but probably would not, have been penned by any one but a commission-merchant. As might be expected, the author's practical training produces the best results in those parts of the subject where a personal concern in affairs is essential to a thorough understanding. His chapters on banking, commerce, and credit are clear and incisive. There is no striking novelty in them, but the fresh and vigorous style clothes the old ideas with a living interest. In his treatment of the fundamental definitions and generally accepted principles of scientific economics, Mr. Danson is in many respects rather original than convincing. While deprecating the confusion that arises from the use of the same term in different meanings, he defines 'profit' in an entirely novel manner, and, on the strength of this, goes on to combat the theories of profit that have been proposed by economists who retain the old definitions. He maintains that profit is earned only by risk: it is therefore inseparable from capital. The manager who conducts business on borrowed capital receives only wages; for the lender risks the loss of his capital, and the additional rate of (so-called) interest he receives to cover the risk is really the 'profit.' On this theory, it is evident that Mr. Danson would limit the term 'interest' to the remuneration for loans on which the security is absolutely perfect, or, in general, to a purely hypothetical quantity, and would use 'profit' principally to denote the income of insurance companies. We doubt that economists generally will follow him.

'Rent' is another term in respect to which our author courts originality. He regrets the variety of meanings assigned to the word, and proceeds to mend matters by setting forth an entirely new one. We shall not follow him in his career. Ricardo will doubtless survive the latest sceptic's assault. The result of our author's doctrine is wrought into a radically conservative view of the modern land-question. Henry George is neatly annihilated by a demonstration of the fact that there is no such a thing as an 'unearned increment' in the value of land. The general treatment of the land-question indicates a probability that some of the profits, or rather 'wages,' of the commission-merchant have found investment in an English estate.

On the labor and wages question, Mr. Danson cleaves to the old school. The interests of labor and capital are identical, and all that the laborers have to do is to eschew trades-unions and become millionnaires as soon as possible. Inspection-laws for factories, like poor-laws, are inherently vicious, and, in general, *laissez faire;* some of which sentiments indicate that a Liverpool commission-merchant feels under no necessity of advancing merely because the rest of the world does.

WM. A. DUNNING.

SOME RECENT MINERALOGICAL TEXT-BOOKS.

Manual of mineralogy and petrography. By JAMES D. DANA. 4th ed. New York, Wiley. 12°.

THE well-known manual of Professor Dana appears in much its former guise, but with such alterations as are needful to keep it abreast of the progress made in mineralogical and petrographical science during the nine years which have elapsed since the publication of the third edition. The old arrangement is preserved throughout, which will prove acceptable to those who are already familiar with the book. It is only intended for an elementary treatise, for the use of schools or of the practical miner and geologist: hence the arrangement of the species according to their principal metallic base is advantageous. The full list of American localities and the tables for determining minerals are also valuable addenda. The chapter on rocks has undergone extensive changes. The terms 'petrography' and 'petrology' are preferred to 'lithology,' which was formerly used. The various grounds of classification are stated, and the rocks divided into, 1°, calcareous; 2°, fragmental, not calcareous; 3°, crystalline, not calcareous. The arrangement of the members of the last class is much like that of Rosenbusch. The banded and schistose varieties are classified with the massive ones, but they are for the most part considered 'metamorphic,' by which term the writer seems to imply that they are altered sediments. The metamorphism of eruptive rocks into schists seems hardly to have secured recognition. Altogether the book is increased by only forty-three pages, but its many improvements will secure it a welcome among all teachers.

Tables for the determination of common minerals. By W. O. CROSBY. Boston, J. A. Crosby. 8°.

Professor Crosby's tables are intended to aid beginners in the identification of the commoner minerals, chiefly by means of their more apparent physical properties, and then to show them how the determination may be confirmed by simple chemical tests. The classification is, 1°, according to lustre (metallic and non-metallic); 2°, according to the color of the metallic, and the streak of the non-metallic minerals; and, 3°, according to the hardness. In this way forty-one classes are formed, which are further subdivided in the analytical key by specific gravity, texture, crystal form, cleavage, etc. The method is the result of

five years' practical experience, and must possess great advantages for the class of students for whom it is intended.

A catalogue of minerals alphabetically arranged. By A. H. CHESTER. New York, Wiley.

Professor Chester's catalogue is best described by an extract from its preface: "This list is intended to embrace all English names now in use in the nomenclature of mineralogy. It includes species, varieties, and synonymes. Well-authenticated species are put in full-faced type. Dead and useless names have been omitted, so that the catalogue can be conveniently used as a check-list and in cataloguing collections." The list seems very complete, and admirably adapted for purposes stated by its author. G. H. WILLIAMS.

THE CHEMISTRY OF THE SUN.

MR. LOCKYER'S new book is unquestionably the most important work in the department of astronomical physics which has appeared for several years: it is especially interesting and valuable as coming, not from a compiler and dealer in second-hand materials, but from an original worker, who has himself made most of the observations and investigations on which his conclusions depend. We do not mean, however, to imply that he either ignores or is ignorant of the work of others, or fails to make proper use of it: in fact, he brings together a very complete account of all that bears upon his subject, with due credit to his fellow-workers and a generous appreciation of their labors and opinions, even when their conclusions differ from his own.

While the book can perhaps hardly be called a 'popular' exposition of its subject, it is certainly not *un*-popular, — not unnecessarily technical or abstruse; and the vivid, enthusiastic, perhaps here and there just slightly sensational, style of the author helps to make it attractive: so that it seems likely to be far more extensively read than most volumes of its class.

The main purpose of the writer is to present the spectroscopic evidence in favor of the hypothesis that our so-called elements are not truly elementary, but so constituted that they can be broken up, or 'dissociated,' into still more elementary components by the action of heat; and that on the sun and stars they are actually so dissociated by the high temperatures there prevailing.

In the preface, after pointing out the decomposing power of higher and higher temperatures as actually observed in our laboratories, the author adds as a sort of summary of his argument, "The question then, it will be seen, is an appeal to the law of continuity, nothing more and nothing less. Is a temperature higher than any yet applied to act in the same way as each higher temperature which has hitherto been applied has done? Or is there to be some unexplained break in the uniformity of nature's processes?"

The chemistry of the sun. By J. NORMAN LOCKYER. New York, Macmillan. 8°.

The first seven chapters of the twenty-eight which make up the book are mainly historical, occupied with an account of spectroscopic work previous to 1866, and giving perhaps the best *résumé* of the work of Wollaston, Fraunhofer, Kirchoff, Angstrom, and others, that can be found in the same space. The next three chapters discuss what the writer calls 'A new method in spectroscopy,' and its results. The 'new method' consisted merely in attaching the spectroscope to a telescope, and studying the spectrum of an object in *detail*, instead of in gross, so to speak. Huggins seems to have been the first to employ this 'new method' in his examination of the nebulae in 1864; but Mr. Lockyer was the first to employ it upon the solar surface in 1866.

The results were the recognition of many peculiarities in the spectra of sunspots and faculae, the development of the method of observing the chromosphere and prominences without an eclipse, and the detection of remarkable modifications of many lines in the spectrum, such as widenings, reversals, contortions, etc., all significant and evidently depending upon the physical conditions of temperature and pressure prevailing at that special point of the solar surface which happens to be imaged on the slit of the spectroscope at the moment of observation.

This is followed by an account of the author's early laboratory-work, especially his investigation of the so-called 'long and short lines' in elementary spectra, and the coincident lines in different spectra. This brings us down to 1873.

The next three chapters discuss the 'difficulties' that had presented themselves, and seemed to require a remodelling of the received theories. Our space does not permit a presentation of these difficulties here; but it must suffice to say that they are such as absolutely to compel us to suppose that a given element, such as iron for instance, either gives widely different spectra under different circumstances, the spectrum tending towards simplicity under the very highest temperatures, or else that it is decomposable.

This idea, that our elements are only relatively elementary, while really composed of still simpler substances, is no new one, as Mr. Lockyer himself points out, but had previously been brought forward, and more or less strongly advocated, by Dumas, Brodie, Sterry Hunt, and others, though not on spectroscopic grounds.

The succeeding chapters give us an account of the author's elaborate photographic study of the solar and metallic spectra, a fuller statement and discussion of the dissociation hypothesis, and a comparison of it with certain test-experiments and with the observations that have been made upon the spectra of sunspots and of the chromosphere.

The twenty-fifth chapter deals with the results deduced from the observations of recent eclipses; the twenty-sixth is devoted to the 'basic lines,' to which the author still clings with something like a parent's tenderness for a feeble child; the twenty-seventh deals with the spectroscopic phenomena of the electric arc; and the twenty-eighth and final chapter gives a sort of summing-up and general application of the hypothesis to the phenomena of solar physics.

As to the 'basic lines,' which if really existent would amount to something hardly short of a demonstration of the dissociation hypothesis, the author frankly concedes that the apparent coincidences between the lines of different metals are not exact when examined with sufficient dispersion, but he maintains that the near approach to coincidence is hardly less significant, and appeals to the observations of lines affected in the spectra of sunspots and prominences to show that the 'basic lines' are essentially different from other lines. It is certainly true, that, as compared with other lines, these 'basic lines' are observed with very disproportionate frequency and intensity; but to most spectroscopists it appears that a sufficient explanation exists in the fact that each of them is double or multiple, having each of the components separately affected. In most cases the thickening or reversal of a line is a very delicate phenomenon, difficult to make out at best; and, when two or more such lines happen to stand close together, they catch the eye more readily: probably that is all.

Taking the whole work through, it may be said, that, while here and there passages are open to obvious criticism and objection, Mr. Lockyer undoubtedly makes out a strong case in favor of his 'dissociation hypothesis' by showing its accordance with the phenomena of the solar and stellar spectra. At the same time the alternative hypothesis that an elementary molecule, *without breaking up*, may, after the analogies of allotropism, be capable of very different modes of vibration under different circumstances of pressure, density, and temperature, and so give entirely different spectra, — this hypothesis seems equally reconcilable with observed facts. And it does not encounter the difficulties, which Mr. Lockyer barely alludes to, that our present chemical elements seem to be set apart from all compound bodies by Dulong and Petit's law of atomic heats, and Mendeljeff's periodic series. Until this difficulty is overcome, — we do not mean to imply that it is necessarily insurmountable, — we doubt whether most physicists and chemists will be disposed to abandon entirely the hypothesis of 'multiple spectra' for that of 'dissociation.'

PROFESSOR LEIDY, in the *Journal of comparative medicine and surgery*, communicates his observations on the subject of tape-worms in birds. He finds that birds are as much infested with intestinal worms as other classes of animals, and that none appear to be exempt, no matter what may be the nature of their food, though aquatic birds appear to harbor a greater number of species, as exemplified by ducks and geese. Among the parasites, tape-worms — mostly of the genus Taenia — are common, though less so than the thread-worms. The domestic fowl in Europe has been reported to harbor half a dozen different species of Taenia, though Leidy has observed but one in our domestic fowl, and this but rarely. In the turkey, guinea-fowl, and pea-fowl, no species has been observed. In the sage-fowl (Centrocercus urophasianus), tape-worms are often found in large numbers, sometimes so as to distend the intestines: the species seems to be Taenia microps Diesing. The reed-bird or rice-bird (Dolichonyx oryzivorous) is also infested with tape-worms (Taenia pestifera). Leidy has found that in a bunch of a dozen obtained in the Philadelphia market three or four individuals will contain this parasite. The thin birds are the ones especially affected, the fat ones being commonly exempt. Tape-worms have also been found in the yellow-breasted chat (Icteria virens), the cow-bird (Molothrus ater), the quail (Ortyx virginianus), the chuck-wills-widow (Antrostomus carolinensis), the blue heron (Florida coerulea), the robin (Turdus migratorius), the woodcock (Philohela minor), and in the horned grebe (Podiceps cornutus).

— Dr. Wilcox of Washington, D.C., writes to the *Medical record* that the cow-boys of Idaho treat animals affected with 'loco' poisoning, to which he has already referred in *Science*, by amputating the tails of the affected animals. The paralysis is due to congestion of the spinal cord, the posterior parts of the body being first affected. The plants which are charged with producing this poisoning are Oxytropis Lambertii, Astragalus mollirimus, and possibly others of the leguminosae. The cow-boys call these plants 'larkspur,' although true larkspur is not found in their line of march, nor at the season when loco-poisoning occurs.